robot_workspaces/main.htm, (Sept. 5, 2001). Applicants respectfully submit that the claims and description are clear in view of Applicants' conventional use of known terminology.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the objection to the specification under 37 CFR 1.71 and the rejection of claims 24-31 under 35 U.S.C. § 112, first paragraph.

2. Claims 24-31 are rejected under 35 U.S.C. § 103(a), as being unpatentable over Zilles in view of Buote. Applicants respectfully traverse this rejection, as applied to the claims as amended.

The invention, as claimed in independent claims 24 and 30, relates to a method and a system for the automatic calibration of a workspace volume of a haptic interface. The haptic interface provides an interface between a user and a computer. Specifically, the interface provides tactile sensory feedback to a user and locates the position of a user within a 3D volume of space. Independent claim 24 is directed to methods of automatically calibrating the haptic interface within that volume of space. Independent claim 30 is directed to a system, i.e., a combination of components, that is used to automatically calibrate the haptic interface in that volume of space. Generally, the present invention calibrates the workspace volume of the haptic interface by initializing a position of the haptic interface and tracking the angular orientation of a rotary element of the haptic interface.

Zilles discloses method and apparatus for determining forces to be applied to a user through a haptic interface. The method includes the steps of generating a representation of an object in a graphic space, sensing the position of a user in real space, determining the user's haptic interface in graphic space, determining the user's fiducial object in graphic space, and

determining a force to be applied to the user. See column 2, lines 48-58, of Zilles. The apparatus includes a position sensor, a processor for executing an algorithm to determine the forces to be applied to a user in real space, a display processor, and a force actuator. See column 3, lines 1-12.

Generally, Zilles describes generating a representation of a real world object, identifying a user's position relative to the representation of the object, and applying a force to the user, wherein the force corresponds to the user's position relative to the representation of the object and the nature of the object. Essentially, Zilles relates to generating force-feedback to a user of the haptic interface. Zilles discloses the concepts of real space and graphic space; however, Zilles is silent with respect to calibrating a volume in either space.

Buote discloses an apparatus for measuring angular position and a system for automatically calibrating a potentiometer controlled angular position control device. See column 1, lines 6-10, of Buote. The apparatus includes a rotatable mechanism and a potentiometer coupled to the rotatable mechanism. The potentiometer is adapted to produce an output signal indicative of the angular position of the rotatable mechanism. See column 2, lines 17-22. Buote further discloses a robot 11 mounted on a turntable 12, the angular positions of which are tracked by the disclosed apparatus. See generally column 3, line 50, to column 4, line 65. Buote discloses a system for determining the angular position of a robot; however, Buote fails to disclose methods or systems for automatically calibrating a workspace volume. Buote also fails to disclose any system as applied to a haptic interface.

Neither Zilles nor Buote, alone or in combination, teach or suggest methods or systems for **automatically calibrating the workspace volume of a haptic interface**. As discussed

a1 End

determining a home position for the rotary element; and

geometrically centering a user reference point in a workspace volume and a remote environment by comparing the angular orientation of the rotary element with respect to the home position of the rotary element.

2 ~~26~~. (Amended) The automatic workspace volume calibration method of claim ~~24~~ 1, wherein an encoder is used to track the angular orientation of the rotary element.

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3 ~~27~~. (Amended) The automatic workspace volume calibration method of claim ~~24~~ 1, wherein a proximity switch is used to determine the home position of the rotary element.

4 ~~28~~. (Amended) The automatic workspace volume calibration method of claim ~~24~~ 1, wherein a microswitch is used to determine the home position of the rotary element.

5 ~~29~~. (Amended) The automatic workspace volume calibration method of claim ~~24~~ 1, wherein a potentiometer is used to track the angular orientation of the rotary element.

8 ~~30~~. (Amended) A system for automatic workspace volume calibration of a haptic interface, comprising:

at least one rotary element;

at least one flag disposed on the at least one rotary element;

a user interface connection for moving the at least one rotary element through a range of motion thereof; and

means for determining angular orientation of the at least one flag to geometrically calibrate the work volume.

9 ~~31~~. (Amended) The system for automatic workspace volume calibration of a haptic interface of claim ~~30~~ 8 further comprising:

a second flag disposed on the at least one rotary element and forming a gap between the at least one flag and the second flag; and

means for determining angular orientation of the second flag and the gap to geometrically calibrate the work volume.

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10 ~~32~~. (New) The system for automatic workspace volume calibration of a haptic interface of claim ~~30~~ 8 further comprising a cable coupled to the at least one rotary element to transmit force thereto.

~~33~~ 6. (New) The automatic workspace volume calibration method of claim ~~24~~ 1, wherein a cable coupled to the haptic interface transmits force to the rotary element.

~~34~~ 7. (New) The automatic workspace volume calibration method of claim ~~24~~ 1, wherein a potentiometer is used to determine the home position of the rotary element.

REMARKS

Applicants appreciate the Examiner's courtesy in conducting the telephonic interview with Applicants' undersigned representative on November 30, 2001.

The specification is objected to under 37 CFR 1.71; claims 24-31 are rejected under 35 U.S.C. § 112, first paragraph; and claims 24-31 are rejected under 35 U.S.C. § 103(a), as being unpatentable over U.S. Patent No. 6,111,577 to Zilles et al. ("Zilles") in view of U.S. Patent No. 4,978,846 to Buote ("Buote").

Applicants hereby add claims 32-34, cancel claim 25, and amend claims 24 and 26-31. No new matter is being added thereby. Claim 24 is being amended to incorporate the subject matter of now cancelled claim 25 and to more clearly define the Applicants' invention. Claims 26-31 are being amended to depend from claim 24 instead of now cancelled claim 25 and to more clearly define the Applicants' invention. The claim amendments and new claims 32-34 are fully supported by the originally filed specification at, for example, page 6, lines 19-21; page 18, line 22, to page 19, line 2; page 20, lines 4-6; and claim 25, as filed. Claims 24 and 26-34 are currently pending and presented for reconsideration.

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